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FIRE/PARTY WALL SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/415,826, filed October 3, 2002.

TECHNICAL FIELD

[0002] The present invention relates to multi-unit dwelling construction in general and in particular to party walls separating adjacent units of a multi-unit dwelling.

BACKGROUND

[0003] Multi-unit residential buildings have been constructed for many years, and employ a wide variety of architectures and methods of construction. Typically, in one of the most common constructions, the multi-unit buildings comprise a series of units disposed side-by-side. Adjacent units share a common wall known in the art as a party wall or a fire wall, hereinafter referred to as a party wall. Interior units have two party walls, one on each side, while each end unit has only one party wall shared with the next most proximate interior unit. Building codes commonly include special construction requirements for party walls which insure a specified degree of fire resistance, usually specified in terms of hours. In order to obtain the required fire resistance, prior party walls have been constructed of fire-resistant materials such as concrete block, brick, cinderblock, gypsum board or a combination of like materials.

[0004] An additional requirement of party walls is sound resistance. Families and occupants of individual units generate a certain degree of noise during their daily living routines, and also when entertaining guests during special occasions. Typically, the occupants of adjacent units do not celebrate or entertain at the same time, thus to prevent disrupting the privacy and quiet enjoyment of occupants, it is highly desirable to not transmit sounds between units. Building codes also typically require a minimum degree of sound impedance through a party wall.

[0005] The construction of the multi-unit residential buildings can be performed in a serial manner in which an end unit is first constructed, then each subsequent unit

is built to an end of the preceding unit with the shared party wall constructed in turn. In an alternative method of construction, the individual units can be simultaneously constructed at the same time, or construction can start with an interior unit with subsequent units being added to each side thereof wherein the party walls are constructed as each unit progresses. Construction in this manner is inefficient because it requires scheduling various skilled trades in a particular order. For example, if the units are built serially as described above, the basic residential unit can be of typical wood construction requiring carpenters for the initial framing before a first party wall can be built. When the construction reaches the point of building the party wall, the carpenters yield to such skills as masons for the construction of a concrete block party wall. When the party wall is complete the carpenters return for framing the next unit and continue alternating with the masons until all units are built. As one can readily see, this is an inefficient utilization of an increasingly expensive labor force.

[0006] Previous methods of party wall construction using blocks or bricks are labor intensive and require skilled, on-site labor. These drawbacks have given rise to the prefabricated party wall industry. Prefabricated party walls typically include a frame that is covered with fire-resistant sheets on both sides and filled therebetween with an acoustic insulation. Although this construction approach is more efficient than on-site construction, it is still labor intensive.

[0007] Therefore, there is a need in the industry for a modular party wall that utilizes minimum skilled labor and provides increased fire resistance and reduced acoustic transmission between adjacent residential units of a multi-unit building.

SUMMARY OF THE INVENTION

[0008] One aspect of the present invention is directed to a party wall system for installation between adjacent units of a multi-unit residential dwelling. The party wall system comprises at least one party wall panel having a foam core, at least one structural stud partially embedded in a first face of the core and at least one structural stud partially embedded in a second face of the core, and a concrete member covering the second face of the core. A fire-resistant sheet is affixed to the structural stud in the first face of the core. The fire-resistant sheet is spaced from the first face and

defines a first sound channel therebetween. A spacer is affixed to the structural stud in the second face of the core and exterior of the concrete member. A fire-resistant sheet is affixed to the spacer, and the fire-resistant sheet is thereby spaced from the concrete member and defines a sound channel therebetween.

[0009] Another aspect of the present invention is directed to a party wall panel for use in a party wall between adjacent units of a multi-unit residential dwelling. The party wall panel comprises a foam core having a first face and a second face. At least one structural stud is partially embedded in the first face of the core, and at least one structural stud is partially embedded in said second face of said core. A concrete member covers the second face of the core.

[0010] Yet another aspect of the present invention is directed to a method of fabricating a party wall panel for use in constructing a party wall between adjacent units of a multi-unit residential dwelling. The party wall panel is of the type comprising a foam core, a plurality of structural studs partially embedded in a first face of the core and a plurality of structural studs partially embedded in a second face of the core, and a concrete member covering the second face of the core. The method comprises a number of steps. First, the structural studs are arranged in a desired substantially parallel spaced relationship. Next, a resinous foam is expanded in a manner to form a panel core and embed a portion of the studs in a first face of the core and embed a portion of the studs in a second face of the core, each stud having a cap extending outwardly of either the first or second face of the core. Concrete is poured over the second face of the core to form the concrete member with a thickness substantially equal to the extent of the outward extension of the stud from the second face of the core. Finally, the concrete member is cured.

[0011] These and other advantages of the invention will be further understood and appreciated by those skilled in the art by reference to the following written specification, claims and appended drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In the drawings:

[0013] Figure 1 is an exploded isometric view of a multi-unit residential building wherein party wall panels according to one embodiment of the present invention are placed between adjacent residential units.

[0014] Figure 2 is an elevational cross section of an installed party wall panel and supported in place by a footer and the roof structure according to one embodiment of the invention.

[0015] Figure 3 is a cross-sectional plan view of an installed party wall according to one embodiment of the invention taken along the line 3-3 of Figure 2.

[0016] Figure 4 is an exploded isometric view of an second embodiment of the a party wall system.

[0017] Figure 5 is a cross-sectional plan view of the party wall module of Figure 4 taken along the line 5-5.

[0018] Figure 6 is a cross-sectional view of a stud having a void space for receiving a fastener on a concrete side of the party wall panel.

[0019] Figure 7 is a cross-sectional view of a stud having a foam panel affixed to one cap for permitting the receiving of fasteners in the stud cap on the concrete side of the party wall panel.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] For purposes of description herein, the terms "upper", "lower", "left", "rear", "right", "front", "vertical", "horizontal", and derivatives thereof shall relate to the invention as oriented in Figure 4. However, it is to be understood that the invention may assume various alternative orientations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0021] Turning to the drawings, Figures 1-3 illustrate one embodiment of a party wall system 20, which in the embodiment shown functions to separate two adjacent units 12, 14 of a multi-unit residential building 10. Party wall system 20 provides two basic functions. First the system 20 provides fire resistance between adjacent units 12, 14 to delay the progress of a fire from one unit to the next. Second, party wall system 20 also provides sound isolation between units so that noise emanating from one unit is impeded from traveling to the next unit.

[0022] Party wall system 20, most thoroughly shown in Figure 3, includes as a central structure, a party wall panel 30. Party wall panel 30 has a central foam core 32. Foam core 32 can be made from any foam, and it preferably is made from expandable resinous foam, such as, for example, Expandable Poly Styrene (EPS).

[0023] The foam core 32 has a plurality of structural studs 36, 38 embedded therein. Studs 36, 38 can be of different configurations, but in the preferred embodiment, studs 36, 38 are metal C-channels of the type being used as a replacement for standard wood 2x4's. Studs 36, 38 are arranged in a vertically parallel fashion and are substantially equally spaced one from the other in the lateral direction. Preferably, studs 36 have one of their caps 37 extending from a first face 34 anywhere between one-eighth inch and two inches, and most preferably one-half inch.

[0024] Studs 38 are embedded in foam core 32 and extend through a second face 33. A concrete member 44 covers a second face 33 of foam core 32 and conforms to second face 33. Studs 38 extend from face 33 a distance substantially equal to the desired thickness 39 of the concrete member 44. In a preferred embodiment, concrete member 44 has a thickness 39 of approximately two inches.

[0025] Studs 38, as illustrated in Figure 7, have a web 52, connecting caps 54 and 56. Cap 54 is embedded in the foam core 32, and cap 56 extends outwardly from second face 33 of core 32. Cap 56 is subsequently embedded in concrete member 44. Since studs 38 have spacers 22 attached to an exterior face of cap 56 as described more fully below, provisions are required to permit fasteners (not shown) to be received and extend through cap 56. To prevent concrete from flowing into contact with the inner face of cap 56, a porous member 58 is affixed to the inner surface of cap 56. In the preferred embodiment, member 58 is EPS bonded thereto, although

those practiced in the art will readily recognize that other materials or methods can be used to provide the desired clearance for a fastener to be installed through cap 56.

[0026] In addition to concrete member 44, party wall panel 30 also includes two support columns 46 laterally spaced one from the other, and further wherein each of the support columns 46 is intermediately positioned between two adjacent studs 38. Support columns 46 are thicker than concrete member 44. In the preferred embodiment, support columns 46 are also made from concrete and are formed concurrently with and integral to concrete member 44 so that the columns 46 are integrally connected to member 44. For added stiffening and reinforcement, support columns 46 may include one or more reinforcing bars 48 extending internally there along. Party wall panel 30 can also include concrete edge caps 42 at the lateral ends of panel 30. Edge caps 42 provide a sturdy mating surface for adjoining party wall panels 30 to one another and in the embodiment of Figure 3, cap 42 preferably includes flat surfaces 42'. Flat surfaces 42' function as mating joints between adjacent panels 30.

[0027] Party wall panel 30 is formed by first placing the structural studs 36, 38 in a mold or the like such that they maintain a desired substantially parallel spaced relationship as illustrated in Fig. 3 (i.e. so that in the final panel 30, studs 36 are arranged along a first desired face 34 and studs 38 are arranged in a like manner along a second desired face 33). Resinous foam is expanded in a manner to form a foam panel core 32. The foam expands around, and embeds within itself, studs 36, 38 thereby fixing the studs in their desired substantially parallel spaced relationship. Each stud 36 and 38 has a cap (such as cap 56 of stud 38 as shown in Fig. 7) extending outwardly of either the first or second faces 34, 33 of the core 32. Second face 33 of core 32 is formed to correspond to the desired contour of integral concrete member 44, support columns 46, and edge caps 42. After placing the core 32 (including studs 36 and 38 embedded therein) in a fabrication form (not shown), concrete is poured over the second face 33 of the core 32. The poured concrete fills and conforms to the contour of second face 33 to form edge caps 42 and columns 46. The concrete is further poured so that concrete member 44 is formed to a thickness 39 substantially equal to the extent stud 38 extends from the second face 33 of core 32.

In this manner, the exterior face of caps 56 of studs 38 and the exterior face 40 of concrete member 44 are substantially coplanar. Once integrally formed concrete member 44, support columns 46 and edge caps 42 are cured, the panel can be removed from the fabrication form (not shown) and transported to the building site. Party wall 30 could also be fabricated using the reverse of the procedure enumerated above. Specifically the concrete member 44 could be poured first and thereafter core 32 could be formed against member 44 (using the appropriate form as described above). The timing of when core 32 is formed against member 44 is not critical regardless of the state of cure of member 44.

[0028] In the most preferred embodiment, party wall panel 30 is approximately eight inches thick, eight feet wide, and twenty-nine feet high although panels of other dimensions are contemplated and included within the description herein. The height of twenty nine feet typically corresponds to the height from a basement support footing 13 (Figure 2) to the roof structure 15, 16 for dwelling units 12, 14 having a basement and two stories above the basement. In those instances of construction where a party wall panel of smaller size (i.e. less than twenty nine feet) is required, the transported panel 30 can be cut in the field to a required size. Panels as long as 52 feet high can be easily trucked from the fabrication plant to the construction site using conventional trucking equipment. The nominal eight foot width of panel 30 corresponds to current construction standards wherein studs are typically laterally spaced at sixteen or twenty-four inch intervals and fire-resistant sheets 24 attached thereto typically have a height and width combination of four feet by eight feet.

[0029] Referring again to Figures 1-2, the supporting structure of each individual unit 12, 14 of the multi-unit residence 10 is constructed with a space 18 between adjacent units.12 and 14. A crane (not shown) lowers individual party wall panels 30 through space 18 so that panels 30 rest on basement support footing 13 (footing 13 is preferably composed of crushed rock but can also be formed from concrete). The base of panels 30 are retained in position by basement concrete floors 17 which are poured after positioning of panels 30 in residence 10. The tops of panels 30 are affixed to roof structure 15, 16 and are thus maintained in a vertical relationship with respect to the remaining structure of units 12, 14. Adjacent party wall panels 30 have abutting

edge caps 42. The abutting faces of edge caps 42 are sealed one to the other with a fire-resistant caulk (not shown). The supporting structure of units 12, 14 is free standing and not affixed to party wall system 20. This construction aids in preventing sound transmission paths between units, thereby further contributing to the acoustic impedance between adjacent units 12 and 14.

[0030] After the installation of party wall panels 30, spacers 22 (also known as spacer channels) are affixed to caps 56 of studs 38 with fasteners (not shown) engaging both spacer 22 and cap 56. Spacers 22 are here shown as metal Z-angles. Spacers 22 typically have a height which may range between one-eighth inch to two inches to generally correspond to offset 45. Fire-resistant rated sheets 24 are then affixed to spacers 22 on one side of party wall panel 30 and to the caps of studs 36 on the opposite side of panel 30 thereby defining sound channels 49. The installation of sheets 24 to spacers 22 and studs 36 would typically be done at the same time that the drywall installers are on site drywalling the units 12, 14. Sheets 24 are affixed in a spaced relationship from a respective face of party wall panel 30. Sound channels 49 add further acoustic impedance to the party wall system 20 by creating an air space between sheets 24 and face 34. By increasing the air space (i.e. increasing dimension 45) or by increasing the thickness of concrete member 44 (i.e. thickness 39) the sound impeding capability of wall 20 is enhanced to any required level. In the preferred embodiment as shown in Figure 3, a double layer of fire-resistant sheets 24 are affixed in an overlapping manner such that abutting seams of one layer are not aligned with those of the second layer. In a preferred embodiment, sheets 24 are gypsum board. The party wall panels 30, spacers 22 and fire-resistant sheets 24 thus comprise a completed party wall system 20 between adjacent residence units 12 and 14.

[0031] Referring to Figures 4-6, a second embodiment of a party wall system 120 is illustrated wherein like elements to party wall system 20 are identified with like reference numbers preceded by the numeral "1". Party wall system 120 includes party wall panel 130 which comprises foam core 132 having embedded therein studs 136 which extend through a first face 134 and studs 138 embedded therein which extend through a second face 133 of core 132. In this embodiment, studs 138 are also C-channel metal studs, however cap 156 is formed in conjunction with a second cap wall

159. Cap 156 and cap wall 159 define a space 160 therebetween for receiving fasteners (not show) extending through cap 156. Cap wall 159 prevents concrete from flowing into contact with the inner surface of cap 156 during fabrication of concrete member 144 of party wall panel 130.

[0032] Concrete member 144 and support columns 146 are integrally formed in like manner to those described for party wall panel 30 above. Party wall panel 130, however, does not incorporate concrete edge caps like caps 42 on panel 30. Instead, party wall panel 130 includes a tongue 150 along one edge of panel 130 and a like shaped groove 151 along an opposite edge. In this manner, adjacent panels 130 can be easily aligned with the adjacent panel 130 utilizing the mating of tongue 150 of one panel 130 into groove 151 of the adjacent panel 130. The panels 130 are sealed at their tongue and groove edges using a fire-resistant caulk as described above.

[0033] Party wall system 120 also includes the use of spacers 126 to affix fire-resistant sheets 124 in a spaced relationship to concrete member 144 thereby defining a sound channel 149 therebetween which functions as additional noise insulation. The height of spacers 126 preferably generally corresponds to the desired thickness 145 to which studs 136 extend from first face 134 of core 132 as discussed above. In this embodiment, spacers 126 are shaped as metal sound channels. Those practiced in the art will readily recognize that different spacer geometries can be used to meet the intent of creating sound channel 149.

[0034] In the foregoing description those skilled in the art will readily appreciate that modifications may be made to the invention without departing from the concepts disclosed herein. For example the wall embodiment of Figure 3 is shown using sound channel spacers 22 having a "Z" shaped cross section while the embodiment of Figure 4 shows a sound channel spacer having a "top hat" shaped cross section. One skilled in the art will recognize that these two sound channel spacers are interchangeable in this application and also that numerous other sound channel spacer geometries could also be implemented. Such modifications are to be considered as included in the following claims, unless these claims expressly state otherwise.